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# Reduction of Waste in a Raw Meat Preparation and Packaging Process, by Adjusting a Continuous Improvement Methodology

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**Abstract:** The methodologies for continuous improvement are widely used in any type of industry, they are very efficient for solving problems. Such is the case of a company that processes and distributes raw beef, where an increase in the loss of one of the preparations used to preserve meat was detected. The best known continuous improvement methodologies such as the Deming cycle, the 8D, the seven statistical tools of quality were sought, and a specific process was adapted for this company. It was found that an area of opportunity is affected by different factors that can even come from different sources. Through the analysis of the combination of all these factors with the application of a continuous improvement methodology, it was possible to detect the impact of each factor on the decrease in preparation and with simple actions in each factor, it was possible to reduce the decrease by 84% if the initial shrinkage is compared to the final shrinkage after the application of the corrective actions. Considering that the loss limit allowed by the company is 12%, with the reduction achieved an average of 11% was reached, which is below the limit established by the company. With which it is concluded that the implemented method met the objective.

*Keywords:* Continuous Improvement, 8D Methodology, Waste Control

## 1. Introduction

Within the manufacturing industries, the implementation of continuous improvement methodologies is an activity that has been present for decades, so one of the main concepts that was raised in the beginning is that of quality control during the manufacturing process instead of only inspect the finished product, thus identifying the root cause of the problem as soon as possible (Imai, 1989).

Work teams must use tools or methodologies that are useful to identify the causes of problems, since to have quality a key point is to find the root causes of each problem (Mahto & Kumar, 2008). The causes can be classified into symptoms, first-level causes and high-level causes, the symptoms are considered as a sign that there is a problem, but not as a real cause. First-level causes are those that directly lead to a problem and high-level causes are causes that lead to first-level causes being related in chains of cause and effect that ultimately generate a bigger problem. Finding the root causes is hard work as there may be too many paths to follow and even finding them all may not be enough to generate good results. (Andersen & Fagerhaug, 2006).

The continuous improvement that can be achieved with the application of these types of tools is a factor that cannot always be maintained in organizations, since in the diverse literature found on these topics only the behavioral part of continuous improvement is presented, showing only how it should be done with little focus on how to implement it, by covering this element, the construction of behavior and how to introduce the habit of continuous improvement can be ignored (Bessant, Caffyn, & Gallagher, 2001).

One of the essential methodologies for the analysis of the root cause of a problem is the Plan-Do-Check-Act (PDCA) method that focuses on solving problems in a systematic and continuous way, serving as a pillar for continuous improvement. of the processes (Kennedy, Harmon, & Minnock, 2008). Like the eight disciplines method (8D), it is used to identify and correct the problems that arise most frequently in companies, a practice that is based on facts and focuses on the origin of the problem by determining the cause root, achieving a workflow that is not interrupted, providing short-term solutions that allow work to no stop while a definitive solution is reached (Izaguirre & Párraga, 2017). Some authors call the first stage within the PDCA method as one of the most important, since it is vitally important for the project to have a complete understanding of the current situation in order to decide the necessary actions to be carried out (Shook, 2008). However, when information is

collected in search of the root cause, workers describe reality according to how they perceive it, which makes it difficult to fully understand what is really happening, but to be able to make accurate decisions it is necessary to be based on facts (Sobek II & Smalley, 2008).

Continuous improvement procedures are used in any area of opportunity, such as production, maintenance, quality, etc. This study focuses on a company dedicated to the processing and packaging of raw meat, specifically in the reduction of a preparation called brine, used to preserve and improve the consistency of the meat. The objective is to reduce the use of brine in the higher quality area, where the depletion exceeds the allowed limits.

## 2. Methods

In an analysis of the PDCA method and the 8D, it can be concluded that they have a common structure which leads to problem solving, when contemplating the structure of both, the steps to be followed for each one can be equated so that the phases complement each other (Bosch Group, 2013). In this case study, the PDCA method will be taken as a basis and will be complemented with the 8D, joining the two methodologies in four phases, which are described below:

- Phase 1, Planning - Its objective will be to fully define the problem, forming a work team where the members are people responsible for each area involved in the situation to be solved, seeking that the details of the problem are described from various perspectives and following the idea If the work flow is not interrupted, containment actions must be taken to prevent the problem before the final solution.
- Phase 2, Realization - Its objective is to start with containment actions, which provisionally solve the problem, allowing brainstorming to identify the root cause of the situation, corroborating each of the causes with historical data to know the situation and the trend of the problem, reaching a definitive solution.
- Phase 3, Verification - The objective of this stage is to carry out the definitive corrective actions to the identified root cause. If there is more than one root cause, it is proposed to divide the actions to be followed from a monetary approach, first performing the actions corrective measures that do not generate an economic investment and later the actions that do generate a cost.
- Phase 4, Preventive Action - At this stage, agreements and strategies must be established so that the established actions continue to be respected and the same failures are not repeated in the process. In addition to following the last discipline of the 8D and holding a final meeting to thank and recognize the team's work.

## 3. Case of study

The case study presented in this article is applied in a company dedicated to the production and packaging of raw beef, more specifically in the area that processes superior quality meat, the operations of this area are shown in the Figure 1.

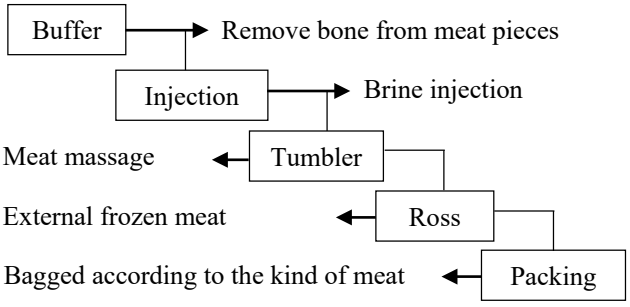


Figure 1. Diagram

The critical part of the process is in the injection operation, where the meat is treated to improve its quality based on the injection of a certain percentage of brine that is calculated according to the weight of the piece of meat to be improved. The problem to be dealt with in this case is the loss of inputs in this operation, the percentage of brine loss allowed in the company is 12% per day, which is exceeded. Brine waste is generally not taken into account, the machine operators and the area supervisor are not sensitized as to the amount wasted per day and what it represents in terms of loss for the company.

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The objective of this case study is to reduce the percentage of brine loss, which is why the use of the PDCA method complemented with 8D is proposed. To start with stage 1, those responsible for all the areas involved in the process meet, seeking to ensure that everyone is aware of the problem to raise awareness about the importance of reaching a solution with the commitment of all those involved, the discussion is made that in the area the brine spill is perceived with the naked eye at various points in the process, but for everyone it was not something to worry about until what was lost was detailed in quantity. When analyzing the situation in depth, a multidisciplinary team was proposed that would be in charge of satisfying the needs of the process, starting with a meeting giving a provisional solution to contain the problem before reaching a well-founded solution.

In stage 2, the provisional actions are initiated, opting to review the technical sheets and control based on them, the amount of brine to be prepared and the injection percentage per piece, maintaining constant monitoring to avoid excesses. This action allows the team to look for the root cause of the problem, for this not only the team members are involved, but also the operators who are closer to the area, seeking to brainstorm about the reasons for waste, reaching to the most common causes of waste and based on these, make an Ishikawa diagram that shows in more detail the causes and effects of the problems, among which are waste during injection, leaks in the machine, brine in tanks at the end shift and injection percentage not according to the technical data sheet.

Having defined the causes, historical data must be verified to know the current status and the trend that the problem follows. For this, the five-week data is analyzed, obtaining the average loss per week (Figure 2).

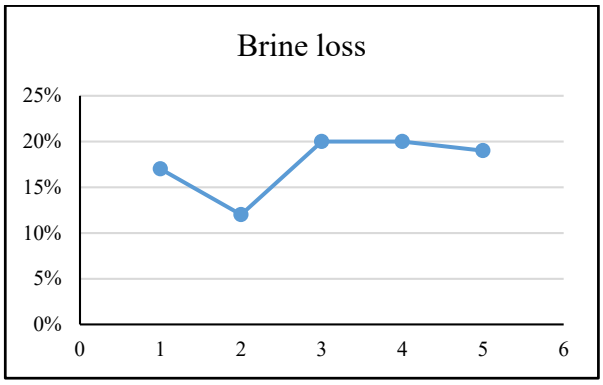


Figure 2. Brine loss trend

When analyzing the data, it was observed that only in one week the average loss allowed was obtained (12%), having this panorama a study is made of the causes found in the Ishikawa to know exactly how much is lost in each indicated part, seeking together with each person in charge the corrective actions to be followed by each one.

In stage three, the corrective actions to be followed for each root cause must be initiated, it begins with the actions that do not require economic investment, which would be the awareness of the personnel involved about the adequate follow-up of what the technical sheets of the operations indicate, as well as the constant communication that must exist between the areas to know how much brine to prepare based on the amount of meat that enters the process, this from the hand of the supervisors so that a continuous monitoring cycle is maintained. Regarding the causes that require economic investment, a diagnosis of the machines was carried out looking for any indication of failure that caused leaks or brine waste, finding very simple defects that caused a loss of significant inputs.

At the end of analyzing the problems, in stage 4 agreements must be reached that prevent the problems from happening again, as soon as the actions of the operators that generated waste, the commitment was made to maintain constant monitoring of the operations, defining a Minutes of commitment that write up the bad practices made by the staff, proposing a corrective action and it is signed as a written commitment. Regarding machine failures, the maintenance department looked for the root causes of these, arriving at a manual for the correct use and maintenance of the machine, thus achieving a culture of good manufacturing practices.

To finish the stages, the work team and the staff were recognized for their outstanding commitment and participation to finish the project satisfactorily.

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## 4. Results

Lack of communication is a factor that directly affected the increase in the percentage of waste, because there was no effective communication between the supervisor of the area and the operator in charge of preparing the brine, causing that at the end of the shift there were practically you fill the tubs that contain it, which equaled 500 liters that were wasted. Applying corrective actions reduced the percentage of shrinkage in that area by more than 50%.

Another example of bad communication is in the injection area, since from the entrance of the meat to this part of the process it began to saturate causing a bottleneck that generated a bad practice when injecting the meat, since it was used the same injection percentage without following what is indicated in the technical data sheet of the operation.

After implementing the corrective actions for each identified root cause, the mission was to achieve the average 12% waste allowed by the company, achieving that during the first week after implementing the improvements, waste was significantly reduced, see Figure 3. During the six days, an average of 7.9% decrease was obtained, which represents the fulfillment of the established goal, achieving that during the week only one day was exceeded 0.7% above the percentage of decrease allowed.

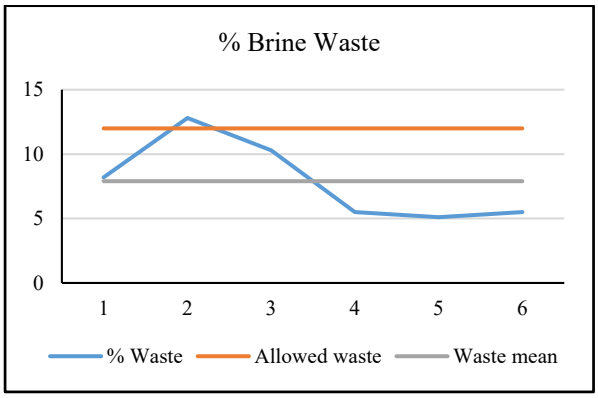


Figure 3. % Brine waste

The brine waste was measured for the next three weeks, obtaining data that again increased the percentage of waste, due to the fact that bad practices were still being committed, but less frequently. In week two after corrections, two days there was an increase in the percentage of decline above what was allowed, but it was not significant since the average for the week was 11%, still below the decline. The following two weeks, the staff had a shift change directly affecting the improvement actions already established with the previous workers, in week three an average of 14.8% decrease was obtained, which is above what is allowed and in the week Four, after implementing the actions again, better results were achieved, lowering the average to 12.8%, although still above what was allowed.

To analyze the total impact of the project, an analysis is made of the data obtained in the weeks before starting with the improvements and the weeks after implementing the corrective actions, when verifying this data, it is obtained that the average percentage of loss before the project is of 18% and after the improvements it is of 11.6%, see Figure 4.

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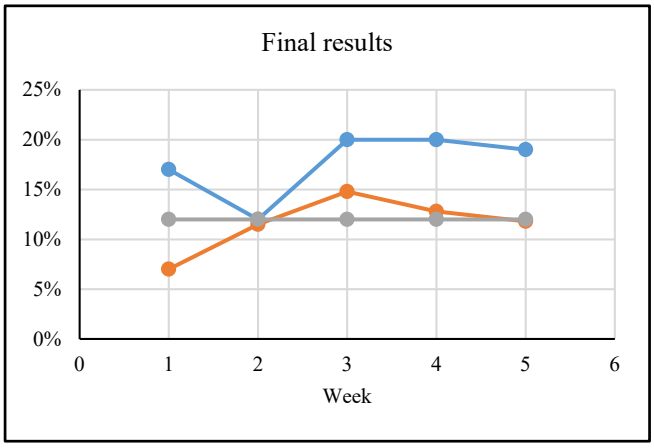


Figure 4. Results

In this way, it is shown that the percentage of waste was reduced by 6.4% and that it is below the allowed percentage, at first 12,000 liters per week were wasted and currently it is reduced to 1,998 liters per week. With this, it can be said that the proposed objective was met, achieving a saving of resources of 80%.

## 5. Discussion

During the implementation of the four phases, details emerged that from the perspective of this project were applied as appropriate. During the first stage, the importance of the multidisciplinary team is emphasized, having people who belonged to different areas, information on possible causes was obtained more effectively and with feedback from different points of view of those involved. Likewise, it is important to highlight the importance of reaching a provisional solution during the beginning of the project, since it avoids a growth in terms of the complications of the problem and thus guarantees that the progress of the project is efficient.

In the second stage, reference is made once more to the provisional solution, since it should only be maintained when a definitive solution is reached, care must be taken with the economic investment, try to apply the provisional solution with the minimum in terms of cost and if possible take actions that do not involve economic investment. It is also recommended that having a brake on failures take advantage of the time managing the information collected on the possible causes with a tool such as Ishikawa diagrams and brainstorming, since they are very useful to accommodate the information and obtain an assessment of each of the causes, allowing more accurate decisions to be made (Laguna, Martínez, Serrano, Hernández, & Guerrero, 2017).

The action taken in stage three that was most useful was the separation of actions according to their economic investment requirement, when starting with actions that do not require investment, management personnel are motivated to notice the differences that cause small actions, getting them to get involved even more in the project and thus more easily obtain support for the actions than if they require investment.

During the fourth and last stage it is fully recommended that sufficient agreements be established so that the improvements achieved are not lost, in this project it was noted that with the change of personnel, the excellent results after applying the improvements fell by a significant percentage, this is why the personnel involved in the area must always be trained. Also during this stage, it is important to hold a final meeting in order to thank the collaboration of all the workers who participated in the improvement procedure, it is a detail that gives extra motivation to the staff to continue with good production practices and thus guarantee that keep up the good results.

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## 6. Conclusions

In any continuous improvement process, the human element is relevant, so it is important that in the continuous improvement methodology enough time is dedicated to raising awareness and training staff, good manufacturing practices must be rooted in the habits of the staff. involved in the process.

In any continuous improvement process, the human element is relevant, so it is important that in the continuous improvement methodology enough time is dedicated to the awareness and training of personnel, good manufacturing practices must be rooted in the habits of the personnel who works in the process.

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